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1867 f. 46

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C

Emma Carter —

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TEN WORDS OF HENRY HARCOURT,
A.D. 1836.

To the Editor of the "Oxford Chronicle."

SIR,—From "The Adventures of a Coal-Mine. By Henry Harcourt. With many engravings. London: 1836." these words have been taken, as a supplement to the Oxford Dictionary. (D.)

Bord. 136. The first process is to form what is denominated a "bord," which is done by digging out the coal from the bottom with a pick, to the depth of three or four feet, (D. not 1839-1708, nor earlier.)

Branchless. 52. It was a stem forty-seven feet long,—a large branchless trunk, (D. 1611 and 1834 only.)

Caking. 42. If we examine a piece of coal, particularly the fat caking quality from Newcastle, (D. 1810 and 1865 only.)

Four-Poled. 90. The three principal articles of furniture in the miner's house are a large four-poled bed, (Not D.)

Futteril. 146. ..., but also by a futteril, or under-ground way, (D. not this spelling of "footrill" before 1883.)

Judd. 137. This, ..., is next formed into a "judd," ... Into this judd a deep sloping hole is then bored, ..., when the judd is shivered into large fragments ... (D. not before 1844.)

Keeker. 144. The *keeker* is an inspector of the hewers, etc. (D. 1818, 1863, 1893 only.)

Thill. 137. ..., by picking away the sides, as had been previously done with the thill; (D. not 1851-1708.)

Turnover. 88. Another table, of a turn-over kind, (D. not before 1849, as an adjective.)

Twilled. 131. "Sir H. Davy afterwards constructed some lamps of *twilled* iron gauze, (Not D. thus.)

To study the history of English words, their changes in sense, sound, and spelling, is a patriotic duty, and very interesting.

May 15, 1917. E. S. DODGSON.

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THE PURCHASE.

THE
ADVENTURES
OF A
COAL-MINE.

BY

HENRY HARCOURT.

WITH MANY ENGRAVINGS.

LONDON:
WESTLEY AND DAVIS;
AND RENSHAW AND KIRKMAN.

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PREFACE.

THE present volume, distinct in itself, and one of a series designed to inform the young as to the means of our national wealth and comfort, is respectfully presented to them and those who are engaged in their instruction, with the hope that it will afford *amusement* while it yields *instruction.*

London, 1836.

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ADVENTURES

OF A

COAL-MINE.

CHAP. I.

How valuable is fire! Of the various creatures on the face of the earth, man is the only one to whom it is entrusted; had it been otherwise, mischief, confusion, and ruin would have soon followed. Here then is wisdom—the wisdom of the Benefactor as well as the Creator of all.

This precious element, as it used to be called, is confined within no narrow limits. Heat is so generally diffused, that we are acquainted with no substance which may be said to be absolutely without a portion of it, whatever may be the degree of cold we experience, or the difficulty, in some cases, of ascertaining its existence. In some bodies it is latent till circumstances call it into action; and of these a variety may be mentioned.

In Terra del Fuego, at the extremity of South America, the natives procure fire by rubbing briskly a piece of pyrites against a flint-stone, and catching the sparks on a dry mossy substance, which is quickly inflamed. This approaches nearly to the means employed by civilized nations, and it may appear strange that so helpless a race as the Fuegians should in this respect surpass the more ingenious inhabitants of the South Seas; the cause will probably be found in the abundance of hard metallic substances in the rocks of Terra del Fuego, while a small bit of metal is a valuable rarity in the islands of the Pacific.

The flint and steel, with the tinder and match of some kind or other, have long been the instruments of getting light in the civilized world.

A tinder of burned rags appears to be the only sort used in England, whilst on the continent a sort of parasitical mushroom is used for that purpose. This substance is cut in slices, soaked in a strong solution of saltpetre and dried; in which state it catches fire by a spark, though not quite so readily as English tinder. The match is generally the same as ours, except in some parts of the south of Europe, where it is made of long strings of cotton like candle-wicks, dipped in brimstone.

Mechanical means of striking fire with the flint have been long known;

the pistol tinder-box, which is merely the lock of a pistol with a large pan to contain tinder, has been in use many years; and as long ago as the fifteenth century, we find a notice of a clock which gave an alarm, and struck fire with a flint, to light a candle at any hour of the night.

Blacksmiths, in some parts of this country, light a fire by striking a piece of soft iron-wire several smart blows with a hammer, by which it is made red hot in a few seconds. The iron is then stuck into a little heap of powdered brimstone and sawdust, which is immediately kindled.

Among recent contrivances is that of the point of a match properly prepared, being quickly drawn through a folded piece of sand-paper, when the friction instantly lights it; and one of a more complicated, yet still very interesting kind. A vessel holds zinc and sulphuric acid, weakened with water, which produces hydrogen gas: a portion of this is made to issue against a small piece of platinum, which it makes red-hot, and the heated platinum then lights the gas, from which a match or piece of paper may be easily kindled. The power of a stream of hydrogen gas to raise platinum to a red heat, on which the effect depends, was only known a few years ago, and its use as a means of quickly obtaining light, is a pleasing instance of the value of chemical knowledge.

CHAP. II.

THE most common article of domestic firing in the less-wooded districts of this country, before the general use of pit-coal, was turf or peat; a kind of fuel still dug and burnt in large quantities where it abounds, and where wood or coal is scarce or cannot be procured.

It has been supposed that the discovery that various kinds of earth or peat, might be used as fuel, might arise accidentally in some place destitute of wood. The heat of the sun, for instance, might be enough; thus in the autumn of 1833, the ground in some places took fire spontaneously, especially in Switzerland: and in the summer of 1834, a moor in Livonia took fire, owing to a long-continued drought. A spark falling on a turf-moor, during a dry summer, has often produced the same effect. In Siberia, about the middle of the eighteenth century, a village, on account of its marshy situation, was removed to another place, and that the remains might be the more easily removed, they were set on fire. The flames having caught the soil, which was inflammable, caused great devastation, and when the traveller Gmelin was there, it had been burning for half a year.

It is scarcely possible to pass, in the summer season especially, through those parts of Ireland which are remote from the capital and the larger towns, without observing, somewhere or other, the labour of the turf-diggers. The turf-spade is not unlike that used by gardeners in shape; but it is lighter and narrower. With this tool the workman first cuts away, in a sort of large square sods, the upper part of the bog; and as this is rather loose and light, it is soon dried and ready for use. On digging lower, the peat becomes more moist and compact, and appears more like rotten wood than the roots of moss; yet it holds together sufficiently to allow of its being readily raised in masses somewhat like large bricks. These clods, which the digger cuts out and throws up with great dexterity, are heaped in a small stack to dry; after which they are either used on the spot, or carted away by purchasers. To preserve them through the winter, the piles are sometimes thatched. On sinking still lower in the bog, the matter becomes less solid, and is a kind of black sludge; this is baled out with a scoop, and is thrown on a smooth floor or bottom, where it hardens in the air; it is then cut and cross-cut with the spade into square pieces, which, on becoming dry, burn with great freedom.

In most parts of the Highlands of Scotland peat-fuel is abundant; and so attached are the people to its fume, that when new houses, built with stone and lime, and having chimneys to carry off the smoke, were built on the estates of the Marquis of Stafford, many of the farmers refused to live in them; and some years passed before others could be reconciled to the clean and cold appearance which they said was produced by the want of smoke.

Wood-fires have been and are still frequent. Children may be seen picking up sticks to make them; and many a cheerful blaze is witnessed as they are heaped up in the cottages of the peasants, and on the hearths of farm-houses. But fires made of wood are now more common on the continent than in England, from the large quantity of coal that is found in our much-favoured country.

Still refuse, and rotten timber, or small gnarled trees, of no value to the carpenter, yield the greater part of the common firing in many parts of this country. Indeed, every tract of woodland gives two kinds of fuel;

namely, *cord-wood*, or that which is laid in stacks during the felling season for the purposes of the charcoal burner, and consisting mostly of such bough-loppings and other waste, as cannot be turned to better account; and *brush-wood*, which, comprising spray, briers, and other matters collected in brushing the ground, is bound with withes into kids or bundles, and sold to the bakers and others.

Through the general consumption of wood instead of coal, a fire for domestic use in France is a great deal dearer than a fire in England;

because, though the coal-pits are not to be found at every man's door, nor within many miles of the doors of some men, machinery at the pits, and ships and barges, enable most men to enjoy the blessings of a coal-fire, at a much cheaper rate than a fire of wood, which is not limited in its growth to any particular district. Without the machinery to bring coals to his door, one man out of fifty of the present population of England could not have had the power of warming himself in winter; any more than without the implements and machines of farming he could obtain food; or without those of the arts he could procure clothing. The sufferings produced by a want of fuel cannot be known by those who have abundance. In Normandy, at the present day, such is the scarcity of wood, that persons engaged in various works of hand, as lace-making by the pillow, sit up through the winter nights in the barns of the farmers, where cattle are littered down, that they may be kept warm by the animal heat which is around them. They sleep during the day, and are warmed by being in the same outhouse with cows and horses at night.

How thankful should we be for our comforts, and how ought we to sympathize with such persons, and those of our own land, of whom Cowper says, in his Winter's Evening:—

" Poor, yet industrious, modest, quiet, neat,
Such claim compassion in a night like this,
And have a friend in ev'ry feeling heart;
Warm'd while it lasts, by labour, all day long
They have the season, and yet find at eve,
Ill clad and fed but sparely, time to cool.
The frugal housewife trembles when she lights
Her scanty stock of brushwood, blazing clear,
But dying soon, like all terrestrial joys.
The few small embers left she nurses well;
And, while her infant race, with outspread hands
And crowded knees, sit cow'ring o'er the sparks,

Retires, content to quake, so they be warm'd.
The man feels least, as more inur'd than she
To winter, and the current in his veins
More briskly moved by his severer toil;
Yet he too finds his own distress in theirs."

CHAP. III.

PERHAPS it may not be useless to remark, that the word *coal*, or as it was formerly more commonly written, *cole*, did not originally signify fossil fuel, as it usually does now, but wood or other matter used for fires. In this sense the term occurs repeatedly in the English Bible; and Thomas Britton, the noted musical "small coal man," was so called, not because he sold broken pit-coal, but little bundles of chopped wood or sticks, used for kindling fires in London. Coal is represented in several of the languages of northern Europe by words similar in sound, as *col*, Saxon; *kol*, German; *kole*, Dutch; and *kul*, Danish.

Authors appear to be agreed that the earliest express mention of fossil coals, used as a fuel by artificers, occurs about two thousand years ago, in the writings of Theophrastus, the scholar of Aristotle, who, in his Book on Stones, says:—"Those fossil substances, that are called coals, and are broken for use, are earthy; they kindle, however, and burn like wood-coals. These are found in Liguria, where there is also amber; and in Elis, in the way to Olympias, over the mountains: they are used by the smiths."

The ancient Britons appear to have used coal. In the neighbourhood of Manchester particularly, which has a vast abundance of it, they could not have been ignorant, it is thought, of this valuable combustible. The currents there, Whitaker tells us, frequently bring down fragments of coal from the mountains: and in the long and winding course of them through the parish, the Britons would soon mark the shining stones in the channels, and by accident or reflection find out their use. But we can advance still nearer to a certainty. Several pieces of coal were discovered some years ago in the sand under the Roman way to Ribchester, when both were dug up at the building of a house. The number of pieces, several of them as large as eggs, was not less than forty; and these circumstances show the coals to have lodged on the spot before the road of the Romans covered it. That ground being in the neighbourhood of Mancenion,—

"the place of tents," an ancient British town, the site of which was the Castlefield at Manchester—the Britons had there laid up a quantity of coals, probably for the use of the garrison; and many of the smaller fragments were buried in the sand on which they were laid. And that the Britons in general were acquainted with this fuel, is evident from its name amongst us at present, which is not Saxon but British; and subsists among the Irish in their *O gual*, and among the Cornish in their *kolan*, to this day.

The extensive beds of coal, therefore, with which the kingdom of England is so happily stored, were first noticed by the skill, and first opened by the labour, of the Britons; and some time before the arrival of the Romans. And the nearer quarries on the confines of Bradford, Newton, and Manchester, would naturally attract the attention, and invite the inquiries of the Britons, before any others. The current of the Medlock, which washes the sides of them, would bring down specimens of the riches within, lodge many of them about the Castlefield, and allure the Britons to a collection of the one and a search after the other.

But, even for ages after the discovery, wood continued to be the general fuel of the nation, particularly so long as the forests and thickets presented themselves readily to the hand, as they did to a very late period. Æneas Silvius, who afterwards assumed the purple under the name of Pius the Second, visited this island about the middle of the fifteenth century. He relates, seemingly with some surprise, that he saw in Scotland poor people in rags begging at the churches, and receiving for alms pieces of stone, with which they went away content. “This species of stone,” he says, “whether with sulphur, or whatever inflammable substance it may be impregnated, they burn in place of wood, of which their country is destitute.” Doles of this, and other kinds of fuel, are still annually distributed in various parts of this country in the winter season; nor is this by any means one of the least acceptable forms under which charity presents her gifts to the poor.

The first public notice of coal is mentioned by Hume to have been in the time of Henry III., who, in the year 1272, granted a charter to the town of Newcastle, giving the inhabitants a licence to dig coals. In the "Household Book" of the fifth Earl of Northumberland, a celebrated and curious record, dated 1512, this fuel is mentioned, but it seems that this family had not learnt to use it by itself, for they said that *coals would not burn without wood!* Eighty chaldron of sea-coal were allowed in the year; and also fifty-four loads of great wood, to make the coals burn. Perhaps what is now called "the main coal" was not then obtained.

Towards the end of the reign of Elizabeth, the coal-trade flourished greatly; but in 1648, fuel was so very dear in London, that many poor people were starved to death—a calamity which was charged on the Governor of Newcastle, for charging four shillings per chaldron on coals. They were not brought into common use till the reign of Charles I., and were then sold for about seventeen shillings a chaldron.

A prejudice like that once felt here, prevails now in some parts of France. Dr. Bennett, a protestant clergyman in Normandy, received orders to quit his house, *because he burned coal;* and another English gentleman at Caen, who had invited a large party, found, to his surprise, that the French did not visit him because he used this fuel.

A preference for wood-fires is very strange, as besides giving much less heat than coal, they are far more expensive. Unpleasant as the fume of pit-coal must be to those not used to it, the burning of fresh wood must also be disagreeable to others. Some billets, however, are free from such objections, while others are even odorous. Thus it is said that the wood of the ash, when burned in a *green* state, will emit a fragrance like that of the violet or mezerion, and sometimes diffuse it to a considerable distance,—a circumstance which has not been observed in any other British wood. But of this we can be sensible only in England, and it is particularly to be noticed in passing through a village when the cottagers are lighting their fires, or by the farm-house, when this wood, fresh cloven, or newly lopped off, is burning; as the wood dries, this sweet smell in a great measure passes away with the moisture, for in this state we are not sensible of any odour arising from it different from other woods.

Our ancestors were not acquainted with the stove; this addition to our comfort belongs to modern times. In the centre of the ancient hall was the rere-doss, or fire-iron, against which faggots were piled, and burnt upon the stone floor, the smoke passing through an opening in the roof immediately over head, which was generally formed into an elevated lantern, a conspicuous ornament to the exterior of the building. In later times, a wide-arched fire-place was formed in the side of the room. By a record of the year 1511, it appears that the hall-fire was discontinued at Easter-day, then called God's Sunday; and the fire-irons being cleared away, the space whereon the fire was burnt, or the hearth, was strewed with green rushes and flowers; whence the custom, in our times, of decorating stove-grates with evergreens and flowers when they are not used for fires.

Now we may say,—

"Who hath not sat beside a glowing fire
Some cheerless night, and watch'd the pageant there
Of cities bristled o'er with dome and spire,

Red, as if glowing in the sunset glare;
Or marshall'd troops that rank by rank expire;
Or steel-clad knight, or lady gay and fair?
The huge world mimick'd! for its fair and great
Moulder to dust as surely, though more late!"

The ravages of fire are very fearful. In Russia, where houses are built in general entirely of timber, they are frequent and often extensive. The fire by which the town of Tula was destroyed, about two years ago, affords an instance to which nothing similar, as to the extent of destruction, has occurred in this country since the great fire of London.

The most usual and effective way of putting out fires there, is by pulling down some of the houses which stand between the fire and the direction in which the flames are driven by the wind. In some parts of Russia, the inhabitants have the idea that nothing is so good as milk to put out fires which are kindled by lightning. These, therefore, are far more destructive than any others: for, in consequence of the small quantity of milk which can be procured, whole villages are consumed which might probably have been saved by a plentiful supply of water, and still more likely by the means just referred to. This strange notion also prevails in some parts of Germany.

Perhaps in no place is there a more remarkable regulation to prevent or extinguish fires, than that in force at Isher-Kask, the capital of the Don Cossacks. On a board which is hung out at each door, are painted figures of the instruments which each housekeeper is bound to have ready, and to attend with when such a calamity occurs. Thus, for instance, at one door is painted the representation of a hatchet; at another that of a water-barrel; and at a third that of buckets, crow-bars, ladders, or other requisites. On the first alarm of fire, the housekeepers are expected to attend at the spot with what is denoted by the figures at their doors.

Fires are in this country unhappily of frequent occurrence, nor would it be matter of surprise were they far more common, considering how careless and thoughtless many people are. It is gratifying, however, to find that at such time help is so promptly given, and one instance of this kind is particularly so.

A fire having broken out in a village of Denmark, one of the inhabitants, a poor man, was very active in affording assistance; but every endeavour to extinguish the flames was in vain. At length he was told that his own house was in danger, and that if he wished to save his furniture, not a moment was to be lost. "There is something more precious," replied he, "that I must save. My poor sick neighbour is not able to help himself; he will be lost if I do not assist him: I am sure that he relies on me." He flew to his neighbour's house, rushed, at the hazard of his life, through the flames, and conveyed the sick in his arms to a place of safety. A society at Copenhagen showed their approbation of his conduct by presenting him with a silver cup filled with Danish crowns.

Children should always be very careful of fire. Many, from playing with it, have been sadly burnt.

Should such an accident happen

to any one who reads this volume, which, however, it is to be hoped never may, it will be well to remember, that to stand or run is very dangerous, because flame ascends rapidly; and that the child did wisely who, when his pincloth caught fire, laid down and rolled himself up in the rug, by which the fire was soon put out. A little knowledge is often of great use. Some time ago, a boy fell into a river; he could not swim, but having read that in such a case it was desirable to do as if he *were walking up stairs,* he did so, and thus floated till some one came and took him out.

CHAP. IV.

If we examine a piece of coal, particularly the fat caking quality from Newcastle, we find it a compact, shining, stony body; but there are few fragments, even of moderate size, in which we may not discover some parts very like charcoal, and very often with the distinct structure of wood or other vegetable matter. Such appearances are most frequently observed in the *slaty* coal of various parts, not only in England but also in Scotland. Our knowledge of the nature of coal has been much advanced by an instrument new in such uses, but which has brought many hidden things to light, in other divisions of the natural world. By an ingenious application of the microscope, Mr. Witham has exhibited a delicate cellular or net-like structure in fossil woods, which, without such aid, presents only the appearance of compact stone; and he has detected the same in coal, by subjecting extremely thin slices of it to this very highly magnifying power.

His researches have been followed up by Mr. Hutton, of Newcastle, who has thereby done much, not only to explain the vegetable origin of coal, but also many things connected with it, which were formerly very little understood. It is stated that, in all the variety of this mineral found in the Newcastle coal-field, more or less of the fine, distinct, net-like structure of the original vegetable texture can always be discovered. The vegetable origin of coal is further illustrated by the vast quantities of fossil plants found in the sandstones and shales which are intermingled with the beds of coal. These are often in an extraordinary degree of preservation, for the most delicate leaves are spread out on them like the dried plants on the herbarium of a botanist. Many drawings have been made from such subjects, and it is a pleasing occupation to have the portfolio brought forth that they may be examined; particularly if the young

can at the same time be interested and instructed.

About three hundred different species of plants have been discovered in the coal measures of this and of other countries; and of these full two-thirds have a close resemblance to ferns. Among the rest, one of the kinds most frequently found belongs to that tribe of plants which botanists call the *equisetacea*, of which the weed so common in our ditches, known by the name of horse-tails, is an example; but while the stem of these rarely exceeds the diameter of a goose-quill, the fossil equiseta are sometimes as thick as a man's arm. Other fossil coal-plants resemble large reeds and canes; and bodies which appear to be fragments of the branches and stems of palms and other trees are of frequent occurrence.

It is a remarkable circumstance, that no remains either of grasses or of mosses have yet been observed in the coal-measures: plants which are not very often absent where vegetation is abundant, especially in moist situations; and the character of the whole fossil flora of the coal-fields shows that the plants must have grown in marshy or humid ground. These terrestrial plants are never mixed with any of those which grow in the sea.

It is a very striking fact, too, that they are generally of such a size as to indicate a degree of luxuriance of growth that is now known to exist only in tropical regions. "It would hardly be credited," says Professor Lindley, in his Fossil Flora of Great Britain, "by persons unacquainted with the evidence upon which such facts repose, that in the most dreary and desolate regions of the present day, there once flourished groves of tropical plants of coniferæ, like the Norfolk island and Araucarian pines, of bananas, tree ferns, huge cacti, and palms; that the marshes were filled with rush-like plants, fifteen or twenty feet high, and the coverts with ferns like the undergrowth of a West India island."

In the greater proportion of the fossil plants of the coal-measures there is little appearance of woody matter. Stems of a foot and a half in diameter have been found with the external form perfectly preserved, but having only a coaly coating of inconsiderable thickness, the interior part consisting of sandstone or clay, with now and then some more coaly matter in the centre, indicating, as it were, the pith. But trunks of trees, in which the woody texture was preserved nearly throughout the whole stem, have often been met with: they have been seen, in the coal-mines of Westphalia, sixty feet in length; and two remarkable instances of fossil-trees in the coal-measures have occurred in Great Britain, which have been well described by Mr. Witham. In a bed of sandstone, near Gosforth, about five miles north of Newcastle-upon-

Tyne, a stem was found which measured seventy-two feet in length, four feet in width at its lower end, from which it tapers gradually, and was eighteen inches wide at the top. It was in a compressed state, as if flattened by great pressure on it, so that the above dimensions of the width are not the true diameter of the stem. The woody structure was, in this instance, only in part preserved, but in those places it was converted into a siliceous or flinty substance, containing cavities lined with rock-crystal; and this petrified portion was, in one place, nearly two feet in diameter. There were no roots attached to it, and no branches; but there were large knots and other places where branches appear to have been broken off.

The other instance occurred in the great freestone quarries at Craigleith, near Edinburgh, from which the greater part of the New town of that city has been built; a sandstone belonging to the coal-field of Mid Lothian, but underlying, it is believed, the regular coal-measures. It was a stem forty-seven feet long,—a large branchless trunk, in some parts very much flattened, the greatest diameter being five feet, the smallest nineteen inches. It was imbedded in the solid stone, with above a hundred feet of layers of rock above it, and it lay across the strata.

The bark was converted into coal; but in the interior the woody texture was in many places perfectly preserved, as was shown by the ingenious process of Mr. Witham abovementioned. It is conjectured to belong to the coniferæ, or fir-tree tribe; but there are some peculiarities of structure which make that doubtful. A large portion of this stem may be seen in the Museum, and another in the Botanic Garden of the University of Edinburgh.

It may be thought, very naturally, that trees and other vegetable bodies, although carried down by the rivers to the sea, would not sink, but would continue to float until, by the gradual process of decay, they would totally disappear. But wood swims in water only in consequence of the air contained in its cells; the substance of wood is considerably heavier than water, and it therefore sinks as soon as the air is withdrawn from it. Very long soaking in water will expel the air, but this will take place more speedily when great pressure is applied at the same time; by which means, in squeezing out the air, the sides of the cells are brought closer together, and the wood becomes more dense. A remarkable instance of this has been related by Captain Scoresby, in his account of his Voyages to the Whale Fishery in the Arctic Regions: a whale, on being harpooned, ran out all the line in the boat, and as the end of the rope was made fast, the boat was dragged by the fish under water to the depth, it is supposed, of several thousand feet;

the men having just had time to make their escape by leaping on a piece of ice. When the whale returned to the surface to breathe, it was killed; but in place of floating, it began to sink as soon as it was dead, in consequence of the weight of the boat, which was still attached to it by the line of the first harpoon remaining in its flesh. The sunken boat was raised with great difficulty, for so heavy was it, that although before the accident it would have been buoyant when full of water, it now required a boat at each end to keep it from sinking. When they got it into the ship, the oaken planks were, Captain Scoresby says, "as completely soaked in every pore as if they had lain at the bottom of the sea since the flood." A piece of light fire-wood, about fifteen inches square, that had gone down with the boat, when thrown into the water again, sunk like a stone. On various and important grounds, therefore, the formation of coal is attributed to trees and vegetables being carried down the rivers of the former world, and deposited in the bed of the sea at a remote age.

The irregularity of the coal-seams

is caused by convulsions to which the earth has been subject. These have produced what the miners call faults or dykes, which often interrupt the labours of the pit, by affording a passage to the water. A fault or dyke is, in point of fact, a fissure or rent, which appears to have been made by some fearful power.

There is one very remarkable circumstance in the history or description of coal-districts; viz., that numerous beds or seams of coal occur in the same field, although it rarely happens that more than two or three are of sufficient thickness to bear the expense of working.

This fact, of so many *coal-seams* or strata being in the same field, with the great thickness of some of them, (the main coal in Staffordshire being no less than thirty feet thick, that in the Ashby de la Zouch thirteen, and many seams in other fields in England and Wales, being from six to nine feet in thickness,) with the extensive tracts that these coal-districts are found to cover, must give us pretty correct ideas of the abundant diffusion of this *valuable* mineral, rendered more so by its usual accompaniments of *limestone* and *ironstone;* the former of which would be of comparatively less value without the aid of coal—and the latter, as the abundance of our furnaces and bloomeries, which are scattered over our extensive coal-districts, evidently testify, would be very disadvantageously situated indeed at a distance from these depositories.

What prodigious quantities of this valuable mineral are dug from the numerous mines in the counties of Northumberland, Durham, and Cumberland—Staffordshire, Derbyshire, and Gloucestershire, in England; and from the continuation of the latter into South Wales! And, although the extent of the coal-districts in Scotland is said to be more limited, what a prodigious quantity of this useful article must be included in what may be called its principal coal-district, that extensive tract of country which may be comprehended by looking at a map, and supposing a line drawn from the mouth of the Tay, on the east coast, by Stirling, to the north end of the island of Arran on the west, as forming the northern boundary; and another, drawn from Abb's Head on the east, across the country by Crawford, or to the north of Sanquhar, to Girvan in Ayrshire, on the west, as forming the southern boundary.

No wonder, then, that Mr. Mawe considers this very abundant and useful mineral as the foundation of our national strength, as well as our riches; and worth to England more than all the gold mines in Peru, from its "subservience to our manufactories."

The largest coal-field on the continent is in Belgium; there are smaller ones in several parts of Germany. Coal abounds in the United States. Besides other places in North America, in which this valuable mineral is found in abundance, at a short distance from Richmond there is a large field, twenty miles long by ten broad; and a still more abundant supply on the west side of the Alleganies, where a coal formation, one of the largest in the world, extends, with some interruption, from the western foot of the mountains across the Mississippi. Coal is also to be found in the island of Cape Breton, and has been recently discovered in such abundance on the banks of what *was* called Hunter's River, in New Holland, that its name has, in consequence, been changed, and is now called *Coal* River,—a discovery that must be of the utmost consequence to the infant colony of New South Wales, especially as it is said that plenty of iron ore, and some indications of copper, are also found in the coal-district. Coal in abundance is also met with, particularly near Macquarrie Harbour, in Van Diemen's Land; and, in a letter, dated the 14th of November, 1823, the celebrated Italian naturalist Brocchi, who was at the time employed by the Pasha of Egypt, in directing various scientific researches in the Levant, mentions, that upon his return to

Cairo, he unexpectedly found himself "under the necessity of proceeding to Mount Lebanon, to assist in opening a *coal-mine,* which had been discovered there." Coal is more or less found in a line which sweeps round the globe from the north-east to the south-west.

The most remarkable colliery, or coal-work, that we have ever had in this island, was that wrought at Borrowstounness, under the sea. The veins of coal were found to continue under the bed of the ocean in this place, and the colliers had the courage to work the vein near half way over;

there being a place half a mile from the shore, where was an entry that went down into the coal-pit, under the waters. This was made into a kind of round quay or moat, as they call it, built so as to keep out the sea, which flowed there twelve feet. Here the coals were laid, and a ship of that draught of water could lay her side to the moat and take in the coal. This famous colliery belonged to the family of the Earl of Kincardine; it was worked for many years to the profit of the owners, and the wonder of all who saw it; but, at last, an unexpected tide drowned the whole at once; and the labourers, having no time to escape, unfortunately perished!

A district in which mines are found is called a *coal-field*. *Coal-measures* is the term given by miners to the successive strata or beds which are found with beds of coal, such as slate-clay, freestone, &c.

The traveller who visits for the first time an extensive coal-district, will be struck by the vast canopies of smoke constantly pursuing their sluggish course in the direction of the wind. This smoke arises from the engine fires, and from the small coal burnt at the mouth of the pit. Even on the clearest day these fires give a cloudy aspect to the landscape. On the road from Newcastle to Durham he may find, however, from its being on elevated and rising ground, a series of magnificent views successively burst upon him, almost unequalled in any part of England. At intervals, as he ascends, a wider horizon spreads out before him, the hills are bold and picturesque, and occasionally exhibit in their sweeping outlines combinations of unusual grandeur. When he at length reaches the coal-fields, he will find the face of the country black and blasted; and this, united with the constant clatter of the waggon-trains, may excite in his bosom some gloomy feelings.

But let his first impressions subside, and a more minute inspection of surrounding objects take place, and he will not fail to be struck with the vastness and extent of the commercial enterprise of the district. On every side rise extensive buildings, and in the centre of each, one more lofty than the rest contains that mighty power to which so much is due. These buildings are the works connected with the collieries. In the neighbourhood of the northern coal-fields, a number of mansions grace the landscape—mansions situated in extensive grounds, in which the coal-owners and capitalists, whose property is connected with the collieries, reside.

England is by far the richest country in the world as it respects her coal-mines. They have been the source of greater wealth to her than even the gold-mines of Peru were to Spain, because they are a means whereby man obtains a direct increase of power over materials which minister to his comfort. Were we ignorant how to use these materials, we should be in a state of comparative barbarism, or had we so little skill as to employ them with but inconsiderable effect, the height we have now reached as a people could not have been attained.

CHAP. V.

THE animated parts of the scene in a northern coal-district are not less peculiar than other objects which strike the eye. Occasionally bands of "pit-men," as black as sweeps, each one carrying a safety-lamp hanging at his belt, are seen traversing the dingy lanes on their return from their portion of labour. Their countenances are strongly marked from the nature of their occupation, and their living as they do, apart from other classes of the people. The cheek-bones are high, the middle part of the face is very wide, and the lower portion has an angular form. In these respects they are quite a distinct race from the neighbouring peasantry. The colliers who work in mines where the seam of coal is of sufficient thickness to permit the free use of muscular action, are erect and of good figure; while in others, where the seam is of smaller dimensions, the miners have the spine curved and the legs frequently bowed. Their complexion, when it can be seen in its own hue, is generally sallow and unhealthy.

A very amusing description of the Staffordshire colliers was thus given some years ago, by a writer in Knight's Quarterly Magazine:—

"Many of my readers must recollect crossing, in the route from London to Holyhead, a miserable tract of country commencing a few miles beyond Birmingham and continuing to Wolverhampton. If the volumes of sulphureous vapour, which I shall not compliment with the name of smoke, permitted them at intervals to 'view the dismal situation waste and wild,' they would observe the surface of the desert around them scarred and broken, as if it had just reposed from the heavings of an earthquake. Now and then they would shudder as they passed the mouth of a deserted mine, left without any guard but the wariness of the passenger. Sometimes they would see a feeble and lambent flame, called by the miners the wild fire, issue from chaps in the parched earth. It is self-kindled by a process familiar to the chemist, and feeds on gas evolved by the refuse of the coal that has been left in immense caverns, hollowed by the labours of ages, over which the carriage of the unconscious traveller rolls for many miles. They would be struck also with the sight of houses from which the treacherous foundations have gradually shrunk, leaving them in such a state of obliquity with the horizon, as if they stood only to evince the contempt of themselves and their inhabitants for the laws of gravitation.

" If the traveller, in addition to these attacks on his organs of smell and of vision, has nerve to inspect more closely the tremendous operations which are going on around him as far as the eye can reach, he must learn to endure the grating of harsh wheels, the roaring of the enormous bellows which, set in motion by the power of steam, urge the fires of the smelting furnace till they glow with almost the bright brilliance of the noon-day sun. He must learn to care little for the sparks which fly from the half-molten iron, under the action of the forge, in torrents of burning rain, while the earth literally trembles beneath the strokes of a mightier hammer than Thor himself ever wielded against giants.

“ But my present business is with the human part of the spectacle. The miners, or, as they call themselves, the colliers, are a curious race of men, and the study of their natural history would be replete with information and entertainment. Nothing can well be more uncouth than their appearance. Their figures are tall and robust in no ordinary degree, but their faces, when, by any accident, the coating of black dirt in which they are cased is partially rubbed off, show ghastly pale, and even at an early age they are ploughed in the deepest furrows. Their working dress consists of a tunic, or short frock, and trowsers of coarse flannel. Their holiday clothes are generally of cotton velvet, or velveteen as I believe the drapers call it, decorated with a profusion of shining metal buttons; but they seem principally to pique themselves on their garters, which are made of worsted, and very gay in colour: these they tie on so that a great part, as if by accident, appears below the knee. Their labour is intense. They stand, sit, or crouch for hours, often in the most irksome posture, undermining rocks of coal with a pickaxe.

"The high cheek bones and the dialect of these people seem to argue them of northern descent. Perhaps in some remote age they may have swarmed from the Northumbrian hive to seize on the riches of the less adventurous or intelligent Southrons. Be that as it may, they have clearly no similarity either in speech or feature with the peasantry of the neighbouring districts. They have also manners and customs peculiar to themselves. One in particular is the non-observance, or at least the very irregular observance, of the common rule for the transmission of the surname. What rule they follow I cannot say, but it often happens that a son has a surname very different from that of his father: sometimes a man will have two sets of names, as John Smith and Thomas Jones, and that without any intention of concealment; but, except on high occasions, as a marriage or a christening, they rarely use any appellative except the *cognomen* or nick-name.

"I knew an apothecary in the collieries, who, as a matter of decorum, always entered the real names of his patients in his books: that is, when he could ascertain them. But they stood there only for ornament; for use he found it necessary to append the other, which he did with true medical formality, as for instance, 'Thomas Williams, *vulgo dict.*, that is, commonly called Old Puff.' Serious inconvenience not unfrequently arises on occasions where it is necessary to ascertain the true name and reduce it to writing, not only from the utter ignorance displayed by the owner of all the mysteries of spelling, but from his incapacity to pronounce the word, so as to give the slightest idea of what its orthography ought to be. Clergymen have been known to send home a wedding party in despair, after a vain essay to gain from the vocal organs of the bride or bridegroom, or their friends, a sound by way of name which any known alphabet had the power of committing to paper. The habit of using the cognomen is so common, that the miners apply the custom to strangers with an unconsciousness of offence quite classic. If a traveller should be hailed by the epithet 'nosey,' he should recollect that Ovid endured the same treatment in the court of Augustus without dreaming of an affront, and he may even flatter himself that he bears some outward resemblance to the great poet.

"Indeed, in all communications with persons of higher rank, the miners preserve a bold simplicity of manners far different, at least in my mind, from insolence. I recollect passing through the little town of Bilston at the time of the first abdication of Bonaparte, and being accosted by one of a group of colliers, who, with black faces and folded arms, were discussing the events of the day, with an interrogation, which, imitated in print, might stand thus:

‘ Oy say, what dost thee think o’ the paice, Beoots?’—which being rendered into our language is, ‘ I say, what dost thou think of the peace, Boots?’ My boots were, I suppose, that part of my dress by which I was most conspicuously distinguished from the natives. This I understood as a friendly invitation to a conference on the state of affairs, and my feelings were no more hurt by the designation bestowed on me than those of Hercules ever were by the epithet *Claviger*.” (*Club* bearer.)

The same writer was informed by a respectable attorney, that during his clerkship he was sent to serve some legal paper on a man, whose name and address were particularly given. He traversed the village to which he had been directed from end to end without success; and after spending many hours in the search, was about to abandon it in despair, when a young woman, who had witnessed his labours, kindly undertook to make inquiries for him. Hailing several of her friends, one after another, she asked if they knew a man named Adam Green; but Bull-head, Lie-a-bed, Cowskin, Stumpy, and Spindle-shanks, as they were called, were addressed in vain; each one, with a knowing shake of the head, replying in the negative. She then fell into a brown study, in which she remained some time, when suddenly her eyes brightened, and slapping one of her companions on the shoulder, she said, "Why he means *my father;*" and then turning to the attorney, she stated that he should have asked for *Old Blackbird.*

Notwithstanding the hardships and dangers which the miners daily undergo, they are commonly strangers to poverty and want; their earnings being of an amount not only sufficient to prevent this, but, when properly disposed of, to maintain themselves and families very comfortably. Their cottages, particularly those of the steady and temperate part of them, generally exhibit inside an appearance of comparative cleanliness and comfort, seldom indeed to be met with in the abodes of the poorer classes of populous towns.

A large oaken or fir table for general use usually stands before the window, accompanied on one side by a form of the same length. Another table, of a turn-over kind, and made of mahogany or birch, stands on one side of the apartment, on which are usually placed a few books, commonly called number-books, and a very smart tea-board. These are also "wisely kept for show," for they are seldom used. Indeed, to place every article worth seeing in as conspicuous a light as possible, seems to be the ruling passion of the pitman's wife in household affairs. This is strongly illustrated in the case, where her stock of china is so large as not to admit of being placed on the top of the drawers. So great an aversion has she to putting the superfluous part away, that she places them in a small corner cupboard, and either has a glass door to it, or, if a wooden one, allows it to stand continually open.

The three principal articles of furniture in the miner's house are a large four-poled bed, an eight-day clock, and a chest of drawers. The space beneath the drawers is the receptacle for loaves of bread of unusually large dimensions, but of excellent quality; whilst that between the ceiling of the apartment and the top of the drawers, is always occupied with a lot of china tea-cups and saucers, piled up in the most fantastic manner, and exhibiting the certain consequence of total destruction in the event of suddenly "slipping from their pedestal" by accident or otherwise. On one side of the cheerful fireside is a small oven for baking small cakes, or other necessaries, in those days when the fire is not put to the large ovens which stand at intervals "few and far between" before the doors of colliery hamlets:—

"While broken tea-cups, wisely kept for show,
Ranged o'er the chimney, glisten in a row."

In some cases there is in the neighbourhood of an extensive coal-work a village, inhabited only by the pitmen and other persons who are employed with them, and presenting no very agreeable appearance. The houses consist each of one room, with a wash-house behind, and a chamber over the whole, access being gained to it by means of a ladder. About two hundred such abodes, ranged at irregular distances alongside the road, form one of these hamlets. Heaps of ashes and other refuse are suffered to lie before the front and back-doors; and on these, during fine weather, a number of robust and half-clothed children, of an age too young to be employed at the works, are often suffered to idle away the day. In front of every fifth or sixth dwelling stands a bake-house for common use, which contains a large brick-built oven. Early in the morning, the wife or daughters of a pitman may be seen there with sundry old gossips, to bake a week's bread for the family; and perhaps some surprise would be excited at the sight of the loaves, unless the sharpness and extent of the miner's appetite were known. Before the front window of each tenement stands a pile of small coal, which is replenished every week by a cart-load without cost from the pit.

CHAP. VI.

THE general acquaintance now possessed with the subject before us, will give additional clearness and interest to that history on which we are about to enter. It refers to a portion of the property of an individual which was once large; but thoughtless, idle, and extravagant, he lost it all; and was only saved by acts of kindness on the part of some of his relations, from the lot of those who live on alms.

For a part of his land, which was said to contain coal, Mr. Everton made an offer; and after a short delay, a letter arrived, with an acceptance of it on certain conditions, which were easily arranged. On the final settlement of the purchase being made known to his lady *, she

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* See Frontispiece.

proposed that, in the event of their expectations being realized, the coal-pit should bear the name of the Everton Mine, an appellation which in due time it received.

As Mr. Everton did not wish to work the tract of coal under his own eye, he sent, according to the practice in such cases, for two miners, called in that neighbourhood *Butty* and *Doggey*, who undertook the working of the colliery for a certain part of the proceeds of the sale, Mr. Everton finding the machinery required, and they giving only their labour. The Butty, therefore, became the manager of the concern, as representative of the owner; but as usual, rarely descended the shaft; while the Doggey took the entire management of all the operations underground. Cases occur in which the conduct of such persons is unsatisfactory, but those engaged by Mr. Everton faithfully discharged their trust.

The usual and most certain method of finding out the mineral contents of any given place is by boring, and, therefore, this process was immediately commenced. For this purpose a stage was erected, exactly over the spot for the experiment: a triangle, formed of three poles, fastened at the top, and sustaining a large pulley and rope, was set up; and a flooring of planks was laid down, having a hole in the centre through which some iron rods might work, the lowermost, which was to act on the stratum or bed, being a sort of chisel. By various movements the men now proceeded, chopping and scooping, and thus making way through the understratum in contact with the steel instrument. When the boring was obstructed by the mine stuff produced by the working of the chisel, called wreck by the workmen,—just as the plane of the carpenter is by the wood on which he works—or when they wished to know what stratum they were passing through, the rods were drawn up, the chisel was taken off, and a shell like the common auger of the cooper, was lowered to remove the loose matter.

Having ascertained the existence and workable state of the coal by means of boring, the workmen now proceeded to the sinking of the shaft. This, as well as the labour just mentioned, is not done by the regular colliers, but by a separate class of men, called sinkers.

The situation, form, and size of the pit were then determined, the digging out of the soil to a proper extent was commenced, and a windlass was erected, having a roller worked by a handle, just like that seen over most draw-wells. On this roller a rope was wound, at the end of which was a large iron hook made with a catch, to prevent it from slipping off the bow of the tubs used in drawing up the materials. Two of these were employed, as is commonly the case, so that the empty one was let down while the full one was drawn up.

As soon as the sinking had proceeded some yards, the workmen began to secure the whole interior of the shaft—except where it was very solid—by a lining of brick; after this the sinking was resumed, and in due course another portion of wall was carried up, till it joined the latter part of the former fabric. These operations were then continued as often as necessary.

The borers' joy proved, however, the sinkers' sorrow. In the former case, they had not very frequently to withdraw the rods, which is necessary when the stratum was somewhat soft and dry; but their work went on pleasantly, for a strong spring of water was tapped, the overflowing of which brought up with it to the surface a great part of the wreck as it was produced. But now the water spouted from several parts of the opening, and it was necessary to cut gutters behind the wall, and by fixing boards, to conduct the stream to the floor, that it might be laded out into a large vessel, which was then drawn up by the windlass. As, too, it was wished to render the pit very firm and durable, the interior was cased with wood, by what is called tubbing.

But as the workmen advanced, they found rocky masses, which the common tool could not separate, and therefore they had recourse to gunpowder. This is commonly a dangerous article in the hands of children,

and it is stated that one, after listening to the exploits of some naval officers, made what he called a little fortification, prepared a long train, and at length let a spark fall on it, when, to his great surprise, he found that all the glass in the windows that went down to the ground, were broken, and he received a severe rebuke from his father, for his thoughtlessness.

To blast the rock the miners begin by making a hole in the solid substance, by means of a long stout chisel, which is struck on the head and turned about as it was in boring, care being taken that the opening was neither too shallow nor too deep. It was then charged with gunpowder to the depth of several inches, and a long pricker or skewer was put down and filled about with marl or whatever else was at hand. This was rammed with an iron rod, care being taken not to strike a spark from the neighbouring materials, from which dreadful accidents have sometimes happened. On this being done, the pricker was withdrawn, and a wheaten straw filled with powder, having at the top a slip of burnt paper, was inserted: a light was then applied, and the miner drawn up as quickly as possible. Soon the train was lighted, the sound of the blasting was heard, the mass of rock could not resist the power of the ignited gunpowder, and thus it was rent asunder. Faggots had been placed about to prevent all danger from the fragments, and as much stone was thus loosened in two minutes, as a man could have done by his pickaxe in a week. Now the baskets were filled, and the pieces were easily removed.

But soon a considerable depth was gained, and the labour of drawing up the matter by the windlass was very great; a machine called a gin was therefore set up, the stones and rubbish already removed being used in forming what is called the gin-race, or circular track, in which the horse working the machine was to travel. The power of a horse is considered equal to five or six men at the same kind of labour. One of the persons employed attended to the horse and emptied the buckets, while two others were at liberty to dig and fill below; so that with the gin and horse the labour of many men was saved.

Sometimes this process is long continued. A shaft is now sinking at Monkwearmouth Colliery, near Sunderland, which has reached a greater depth than any mine in Great Britain. It was begun in May, 1826. It discharged towards the bottom of the strata the prodigious quantity of three thousand gallons of water a minute,—for the raising of which a double-acting steam-engine, working with a power of from one hundred and eighty to two hundred horses, was found necessary. About three hundred and forty-four feet below the surface a bed of coal, an inch and a half thick, was reached in August, 1831, after which, the water which had so long hindered the sinking operations, was stopped back by metal tubbing, which reached from the above bed of coal to within twenty-six yards of the surface:

Again the sinking proceeded with great spirit, still no valuable bed of coal was gained, although the shaft had passed considerably more than six hundred feet into the coal-measures. At the great depth of one thousand feet, a new "feeder" of water was met with, requiring fresh pumps, and the spending of more money. Some thought all effort was hopeless; but the owners of the colliery were men of enterprise, and the sinking was continued. In October, 1834, they had reached a seam of considerable value and thickness, at the depth of one thousand five hundred and seventy-eight feet below the surface, and so they are still going on in hope of reaching the Hutton, or most valuable seam, which they expect will be found nearly three hundred fathoms, or one thousand eight hundred feet from the surface. The money spent is said to be not less than from 80,000*l*. to 100,000*l*.

CHAP. VII.

BUT to return to the Everton Mine; a drift was now made to carry off the water, and the shaft was divided by a partition of boards, so as to form upcast and downcast tubes for ventilation, and also to serve for engine-pumps, as well as for drawing coals. Few operations are more unpleasant and dangerous to the workmen than the making of water-drifts, or adits, especially when, as is sometimes the case, they are barely wide enough to allow the sinker to creep along. The perils which arise from blasting the solid rock with gunpowder, in such a small space, may be easily conceived: in the stillness of night the report of these explosions is sometimes heard at a distance of three or four miles. What must be the feelings of a wife who in bed hears at midnight the sound of every shot fired by her husband, engaged in this most dangerous toil?

Many years ago, both the water and coal were usually raised by means of engines worked by horses;

a method in some cases still in use. In 1708, windmills were erected to work pumps in several collieries in Scotland ; but these, although useful at times, were very irregular, and in calm weather the mines were drowned and the workmen left idle.

One of the earliest recorded experiments with the steam-engine was made at the colliery of Griff, near Coventry. The first seen in the county of Northumberland was erected at Byker, in 1714, by the son of a Swedish nobleman, a teacher of mathematics in Newcastle. The steam-engine of Boulton and Watt was afterwards employed, and thus the water was pumped out. What a contrast is often made by the use of this wondrous machine! A pit has been seen in Staffordshire, which hardly gave coal enough to maintain a cottager and his family, for he worked the pit with imperfect machinery,—with a half-starved ass applied to a windlass. A mile off was a steam-engine of two hundred horse power, raising tons of coal, and pumping out rivers of water, with a force equal to at least a thousand men. This vast force acted on one point; and, therefore, no advantage was gained over the machine by the opposing force of water, or the weight of the material to be raised. Before the steam-engine was invented, the produce of the coal-mines barely paid the expense of working and keeping them dry; and had it not been for the steam-engines and other machinery, the supply would long before now have dwindled into a very small quantity, and the price would have become ten or twenty times its present amount.

A steam-engine was used for the Everton Mine, and various evils were now to be guarded against. One was the rushing in of water. The effects of this are in some instances dreadful. By a sudden burst of water into one of the Newcastle collieries, thirty-five men and forty-one lads were thrown into a distant part of the pit, from which there was no possibility of return, until it could be drawn off. While this was effecting, though all possible means were used, the whole number died from starvation or suffocation. When the bodies were drawn up from the pit, seven of the youths were discovered in a cave separated from the rest. Among these was one of very moral and religious habits, whose daily reading the sacred scriptures to his widowed mother, when he came up from his labours, had been a comfort in her lonely condition. After his funeral, a kind friend of the neglected poor went to visit her; and while the mother showed him, as a relic of her son, his Bible, worn and soiled with constant perusal, he happened to cast his eyes on a candle-box, with which, as a miner, he had been furnished, and which had been brought up from the pit with him; and there he discovered the following affecting record of the filial affection and steadfast piety of the youth. In the darkness of the suffocating pit, with a bit of pointed iron, he had engraved on the box his last message to his mother in these words:—

"*Fret not, my dear mother, for we were singing and praising God while we had time. Mother, follow God more than I did. Joseph, be a good lad to God and mother!*"

An interesting instance of spontaneous combustion was formerly seen —indeed, Dr. Brewster says it exists at this moment, near the village of Maiden Bradley, near Bilston, in

Staffordshire. The earth is here on fire, and this fire has continued for nearly sixty years, and has resisted every attempt that has been made to extinguish it. This fire, which has reduced many acres of land to a mere calx, or powder, arises from a burning stratum of coal, about four feet thick, and eight or ten yards deep, to which the air has free access, in consequence of the main coal having been dug from beneath it. The surface of the ground is sometimes covered for many yards with such quantities of sulphur, that it can be easily gathered. The calx has been found to be an excellent material for the roads, and the workmen who collect it often find large beds of alum of excellent quality.

The Stirling Journal contained the following singular notice :—" It is now more than two years since the snow lying on a field on the farm of Shaw Park, belonging to the Earl of Mansfield, was observed to melt almost as soon as it fell, and then rise in a state of vapour. The phenomenon attracted the attention of the managers of the Alloa and Devon collieries, and was found to be the effect of the heat produced by a stratum of coal in a state of ignition, technically known by the name of the Nine-Feet Seam, from which the Devon iron-works are supplied with a large proportion of their fuel. Various plans were, at the same time, suggested to extinguish the flames, and after several failures, it was determined to cut a mine round the seam to prevent their extension. Workmen were set to work to excavate this mine, which was opened at both sides of the seam, to build a wall as they proceeded, on the sides of the two tunnels next the fire. In this way it was intended to proceed, till the tunnel penetrated beyond the fire, when they were to be joined in the form of a horseshoe, and thus cut off, by means of a strong wall, all connexion between the ignited part of the seam and the remainder of it. This plan has been persevered in for a year and a half, but has never been completed. The workmen have often brought two walls within a few fathoms of meeting, but owing to the fire bursting in upon them, they have been hitherto obliged to fall back again and take a wider circle. Six or seven shafts have been sunk to ventilate the tunnels, in which the heat is frequently so great as to raise the thermometer from 212 to 230 degrees of Fahrenheit, it sometimes rises even higher. The lamps of the miners, which are hung upon the walls, have more than once fallen to pieces from extreme heat."

But of all the accidents to which coal-miners are exposed, the explosions of inflammable gas are the most frequent, and by far the most calamitous. The feelings of the reader shall not, however, be excited by minute details of such evils. One is called the choke-damp, and the other the fire-damp. When a man incautiously breathes the first, he is speedily suffocated; when he brings any light to the second, it immediately explodes like gunpowder: sometimes it dashes the body against the roof or pillars with such violence as to break and crush every bone, and at others it tears it as it were to pieces, and leaves it in a frightful state. The approach of these ministers of death is frequently as insidious as it is destructive. At one time an odour of the most fragrant kind is diffused through the mine, resembling the scent of the sweetest flowers, and while the miner is inhaling the balmy gale, he is suddenly struck down and expires in the midst of his fancied enjoyment. At another, it comes in the form of a globe of air inclosed in a filmy case; and while he is gazing on the light and beautiful object floating along, and is tempted to take it in his hand, it suddenly explodes, and in a moment destroys him and his companions. Every year some accident of this kind happens to the poor miners; thus, on one occasion, fifteen persons were wounded, or totally destroyed, by an explosion at Whitehaven; and at Gateshead, near

Newcastle, out of one hundred and twenty-one persons working in the mine, ninety-two were killed, and many of the rest severely hurt.

Sometimes the air is admitted, and circulating through the passages, it dilutes and disarms the dangerous air within; and then the miners frequently receive warning of the choke-damp, of which they avail themselves. For the same air is required to support a taper as is required to sustain life; and that which puts out the flame of the one, will also extinguish the other; whenever, therefore, the lights which the miners use begin to grow dim, they immediately fly, knowing that, if they delayed, they would expire as well as the flame.

As the unwholesome air thus met with is of two kinds, they are also opposite in their effects; for while the one puts out the flame of the candle, the other takes fire from it and bursts suddenly into a flame without any warning. If a poor miner, therefore, brings a light to discover a choke-damp, it may only be to set a fire-damp in a blaze and consume him in a moment. An ingenious expedient was therefore in some cases adopted. The miner strapped round his waist a little machine like a mill. It was a wheel of iron turned by a handle, several flints were placed so that their edges came in contact with the circumference of the wheel, and when the man turned it round with the handle, he produced a stream of sparks, which issued out before him sufficient to guide his steps, but not sufficient to ignite the dangerous gas if he should meet it.

To prevent the accumulation or the fire-damp, it was also a practice, formerly, to set fire to it by the flame of a candle, using the precaution of lying prostrate on the ground during the explosion; but this dangerous course has long been relinquished, except in some collieries where the quantity is so inconsiderable as to render the lighting it mere matter of amusement.

Much honour is due to Sir Humphry Davy for the invention of the Miners' Safety Lamp. In the words of Mr. Brande, this discovery "ranks among the most valuable presents which philosophy has conferred upon the arts: it has already been advantageously employed in mines scarcely before accessible, and its use is daily extending.

"It consists of a common oil-lamp, the flame of which is everywhere surrounded by wire-gauze, the apertures in which should never exceed one-twentieth of an inch square; the wire of which it is constructed may be from one-fortieth to one-sixtieth of an inch in diameter, and of iron or brass, but the former is preferable.

"Sir H. Davy afterwards constructed some lamps of *twilled* iron gauze, containing sixteen wires in the warp, and thirty in the weft.

This material will almost as easily admit the light and air as the ordinary gauze, and is much stronger, so that it will resist blows and pressure.

"The *principle of safety* consists in the cooling power of the wire in regard to flame. If a piece of wire-gauze, sufficiently fine, be held horizontally in the centre of an inflamed jet of carburetted hydrogen gas, it will cut off the upper half of the flame, while the lower half continues to burn; the gas pasess through the wire, and the upper half may still be inflamed again in the usual way, after having been so far cooled by the intercepting wire as to be extinguished. So in the wire cage of the lamp, the gas flame continues to burn, but it cannot make its escape through the wire in an inflamed state, so as to cause an explosion of the external atmosphere."

CHAP. VIII.

To understand the work of mining which now followed, let the reader imagine himself in a gloomy, underground passage, about eight feet high, and fourteen feet wide. This is one of the " ways," as they are called, of the coal-pit, the bottom of which is called by the miners the thill, and the top the roof. Here and there, along the walls of this passage appears a safety-lamp.

The light afforded by the lamps thus suspended along the walls seems to be considerable; but though the visiter can see perfectly well, he still feels encompassed by midnight darkness. In these galleries or passages the miners, or hewers as they are called, carry on their work, in pairs, each taking about twelve feet of the side wall to excavate, and leaving between each such space a space of the same width, on which the roof may securely rest. In getting the coal nothing is done at random. A child, who had bought some fish-hooks, fastened one to a string, this to the hearth-brush, and standing on a chair, pretended to angle; but in this case the wisest plans are pursued that knowledge and experience suggest.

The first process is to form what is denominated a "bord," which is done by digging out the coal from the bottom with a pick, to the depth of three or four feet. This, being completed, is next formed into a "judd," by picking away the sides, as had been previously done with the thill; and when finished, it forms a projecting mass of coal, measuring on its surface about eleven feet by six. Into this judd a deep sloping hole is then bored, which is filled with gunpowder and fired by a train, when the judd is shivered into large fragments and scattered over the floor. In this way much labour is saved, and a larger and more profit-able sized coal is secured for the market.

While this was doing at first, the head-gear for raising the coal was prepared. For this there were two cast-iron wheels, four feet in diameter, with grooved edges for round ropes, raised beside one another on the upper part of a framework of timber over the mouth of the pit, the whole being rendered very substantial by buttresses on every side. The ropes passed from the head whirls to a wooden cylinder, on the axle of a wheel on which they were wound.

The term corfe, from the Dutch *korf*, a basket, is commonly applied to any shallow box, or like contrivance, used for bringing stuff out of the mines: in this instance, as the coals were tender and often broken, a basket-corfe was used of a globular shape, and formed of twigs, having a stout bent iron bow, to which the rope is attached, and moved about on a small low four-wheeled vehicle called a tram. On the coal being detached in the manner above described, the corfe was brought on the tram to the spot by a man and boy, called "a dragsman and foal," and when filled with the scattered fragments, it was dragged to the bottom of the shaft, hooked to the end of the rope, and drawn to the top in about three minutes. On the arrival of the corfe at the mouth of the pit, it was received by the banksman, by whom it was landed. It is his duty to see that it is properly filled, and that the coal-owner obtains his proper measure from the pitman. He also keeps an account of the quantity drawn up, for which service he is paid three farthings per London chaldron.

Connected with the pit there was a contrivance for screening the coals, consisting of a platform sloping from the raised bank about the pit to the ground. At intervals grates were inserted, twelve or fifteen feet long, and about four feet wide, having the spaces between the bars greater or lesser according to the size of coal required to pass through. On each side of these grates boards are placed to confine the coals in their course, and they are likewise boarded underneath, in such a manner as to form the surface of spouts, by means of which the dust and small coal which pass through the bars fall into waggons placed for that purpose, as other waggons are placed outside of them to receive the screened coal. The large and small coal is thus separated, and the latter is collected for inferior purposes. All the large coal for the London market is so carefully sifted, that, on leaving the pit, it is perfectly free from dust and other small particles. The breakage which occurs in its course to the consumer cannot be avoided.

The general direction of a large colliery, as to the scale and disposition of its workings, and also with regard to whatever requires a profound theoretical, as well as a complete practical knowledge, of obtaining the coal economically and safely, is in the north confided to persons called viewers. The *viewer* being not only a person of education, but one who is presumed to have the best information and largest experience as to all matters connected with mining; he is consulted professionally by the coal-owners, and in the degree that he is found to possess judgment and integrity, his services are often retained by several independent concerns. Under him is the *overman*, or person who has the sole direction of the underground economy of a pit, visiting it every morning before the men go to work, and keeping a daily account of the labours of the pitmen. He takes his instructions from the viewer, and every person else in the pit is subordinate to him. The office of an overman is of the greatest importance in the management of a coal-mine, and none but men of tried experience, integrity, and sobriety, should be appointed to fill it. An overman is allowed as many deputies as may be necessary, according to circumstances. The *keeker* is an inspector of the hewers, &c. *Hewers* are the workmen who are actually employed in cutting down the coal in the mines. *Putters* and barrowmen are employed in filling and putting, or pushing the corves or trams to the crane or shaft. *Drivers* are boys employed to drive the horses. *Trappers* are the youngest class of boys, employed to close the doors, which duty is sometimes performed by old men. *Onsetters,* those who hook on and take off the corves below, as the *banksman* does above.

Some collieries, like the Everton Mine, are peculiarly interesting. Thus those belonging to Earl Fitzwilliam, at Elsecar and Rowmarsh, near Rotherham, are carried on with great spirit; the whole of the arrangements for working them are on a scale of great magnitude; at the same time, they are conducted with a degree of care and effect not surpassed by any in the country. The workings are not only approached by means of the drawing shaft, but also by a futteril, or under-ground way, so that timid persons, who might hesitate to allow themselves to be let down by means of the steam-engine, need be under no apprehension about entering by the inclined gallery. There is, moreover, little or no fire-damp, so that the colliers work with open lamps; and so clean and commodious are the board-ways, in many parts at least, that the ladies from Wentworth House sometimes go down to witness the operations, and more particularly to see the impressions of organic remains with which some portions of the strata abound. The roof is beautiful, not only on account of its being in some places richly embossed with impressions, but because it is for the most part as dry, compact, and even as the street pavement itself. The comfortableness of the board-ways under foot, has been, however, materially lessened since the occasion when it was necessary to inundate the works with water from a neighbouring reservoir, in order to extinguish the burning of the beds of coal, which had been wilfully set on fire. But dirty as is sometimes the floor of the mine in many parts, it is by no means impassable to curious visiters.

The entrance of the foot-rail consists of a neat front, with two lodges of hewn stone, having between them an iron gate. One of the shafts is called the Royal William Pit, from the circumstance of his present Majesty having once, when Duke of Clarence, descended, along with some other illustrious guests of Earl Fitzwilliam, to inspect the workings. This august personage is also said, previously, of course, to his accession to the throne, to have once gone down into the deep workings of a coal-mine in Newcastle.

CHAP. IX.

It is by no means easy to specify the various purposes to which the produce of the Everton mine has been applied. A sketch of those which were secured by its early sales is all that can be here attempted.

Many a grate was seen filled with this precious mineral; and as it cast around a genial heat, many an anecdote was told, many an adventure related, and many a smile lighted up the countenance. Much of it was also employed for other domestic purposes. Coal is required for washing, so necessary to health and comfort; for brewing, in order to provide a beverage adapted to those who labour hard in the open air; and for baking the large loaves which are used at dinner, or those which are brought to the breakfast or tea-table.

Other quantities of coal were sent to put in motion the power of the steam-engine, which is capable of being applied to the finest and most delicate manufactures, while its power may be so increased as to set weight and solidity at defiance. Through the genius of Watt it has become a thing stupendous alike for its force and its flexibility, for the immense power which it can exert, and the ease and precision with which it can be raised, distributed, and applied. The trunk of an elephant, that can rend an oak or pick up a pin, is as nothing to it. It can crush vast masses of metal as if they were wax, and it can engrave a seal; it can draw out, without breaking, a thread as fine as gossamer, and it can lift a ship of war, like a bauble, in the air. It can embroider muslins and forge anchors, cut steel into ribands, and impel loaded vessels against the fury of the winds and waves.

The neighbouring gas-works have often had a supply from the same source. This is an application of the mineral of great value. Every one who has sat by a coal-fire must have seen, that when a piece of coal becomes heated, it sometimes begins to swell; it then bursts at a particular part, a stream of air rushes out, and coming into contact with the fire, is ignited into a flame. The same thing may be shown more distinctly by an easy experiment: if a small piece of coal be put into the bowl of a tobacco-pipe, and covered over with moist clay, and the bowl be then placed in the fire, a stream of inflammable air will soon issue from the small extremity of the pipe, and continue to do so until the whole gas of the coal is exhausted. If a lighted match or paper be applied to the orifice the gas will take fire, and burn as in the ordinary lamps. The matter remaining in the pipe will be found to be coke or charcoal. This is the main principle of the present mode of gas-lighting ; and though it has long been known, the application of it to purposes of general usefulness has but recently been made.

An account of the Burning Well near Wigan, in Lancashire, was published by Thomas Shirly in 1667, in which the author opposed the opinion that the waters of the Burning Well were inflammable like oil, as then believed; and correctly remarked, that the flame was produced by the combustion of bituminous fumes issuing from the water, which he felt as "a strong breath, as it were a wind," against his hand; these fumes, he inferred, were produced from the coal-bed which underlies all that part of the country.

The first published account of making coal-gas, was about the beginning of the last century, when Dr. Hales obtained, from one hundred and fifty grains of Newcastle coal, one hundred and eighty cubic inches of gas,—rather more than is now produced in the large way.

Dr. Clayton's experiments were suggested by the burning of the well at Wigan: he not only distilled the gas, which he called the spirit of coal, but he filled bladders with it, and frequently amused his friends by burning it like a candle. The application of this inflammability to any useful purpose seems, however, not to have occurred to any person; and this is one of the many examples of even philosophical and observing men disregarding the useful and important discoveries almost thrown in their way. For many ages the attractive property of amber, when rubbed, was known before the electric fluid was brought into more intense action. The magnifying power of globes of glass was seen by philosophers of Rome eighteen centuries ago, but no one dreamed of telescopes or microscopes. In like manner seal-engraving, and the art of impressing letters and figures on wax and clay, were in practice twenty centuries before the unknown Dutchman or German first thought of using the art of impression as a means of multiplying the art of writing.

Subsequently to these early notices, many distinguished chemists examined the properties of coal-gas, but to not one of them does it appear to have occurred that the brilliant light afforded would be useful in an economical point of view. The merit of this idea must be ascribed wholly to Mr. Murdoch, who, a century after the experiment of Dr. Clayton, first applied coal-gas to any real use, by lighting with it his house and offices at Redruth, in Cornwall. This was in 1792. In 1798, he partially lighted with it the manufactory of Messrs. Boulton and Watt, at Soho, near Birmingham. But the public attention was first drawn to the subject in 1802, when, in consequence of the general rejoicing at the peace of Amiens, it was determined to use gas for the purpose of illumination in front of the extensive buildings at Soho. The experiment succeeded perfectly, and the light was disposed in the tasteful and varied forms of which gas is so susceptible. The spectacle afforded was as beautiful as it was new to the public, and the numerous population of Birmingham came out to gaze and be delighted at the extraordinary display of taste and brilliancy.

The proprietors of the iron-works, not far off, did not forget their old friend, Mr. Everton. To the working of this metal, coal is absolutely essential. In smelting the iron out of the ore—in moulding cast-iron into the articles for which it is best adapted—in working malleable iron and steel—and in applying them to use after they are made—nothing

can be done without fire, and the fuel used, in almost every stage of the business, is coal. So connected are the coal and the iron trade, and so dependent are they on each other, that neither could be carried on to any extent without the other. The coal-mines supply fuel, and the iron-works give mining-tools, pumps, rail-roads, wheels, and other things, in return.

So important is coal in the manufacture of iron, that this is always carried on in the coal-counties. In France there are nearly four hundred charcoal furnaces; but they do not do more than a fourth of the work of smelting iron which is done by our coke furnaces, of which, in England and Wales, there are about three hundred, each producing, when in full work, upon the average, fifty tons a week, or the large quantity of seven hundred and eighty thousand tons a year. A little coal might be procured without the iron engines, and a little iron might be obtained without coals, by the charcoal of wood. But the quantity of both would be trifling in comparison. Thus it is, that to make six hundred thousand tons of iron requires five times the quantity, or three million tons of coal. This large quantity is only for the production of what is called pig-metal, or iron in the state employed by the founder. In other castings, and in the after stages of iron manufacture, many more tons of coal are employed.

The largest iron-works in England are conducted in Colebrook Dale, in Shropshire. This spot, which is situated between two towering and variegated hills, covered with wood, possesses peculiar advantages; the ore being obtained from adjacent hills, the coal from the vale, and abundance of limestone from the quarries in the neighbourhood. The romantic scenery, and the works which are carried on, seem to realize the ancient fable of the Cyclops. "The noise of the forges, mills, &c." it is said, "with all their vast machinery, the flame bursting from the furnaces, with the burning of the coal, and the smoke of the limekilns, are altogether horridly sublime." To complete the peculiarities of this spot, a bridge, entirely constructed of iron, is here thrown over the Severn. In one place it has parted, and a chasm has formed; but such is its firm basis, that the fissure has neither injured its strength nor utility.

But here it must now suffice to observe, that the Everton mine supplied also the maltster, the brewer, and numerous other persons, among whom was the author, who, surrounded by books and papers, la-

boured to inform as well as to interest the mind. While the coal from what has proved a vast repository was employed for so many purposes in the kitchen, it greatly contributed to the comfort of the parlour, furnished the steam-boats, provided for many a jaunt of business and trip of pleasure, and gave to the invalid a dry and warm bedroom, even in the damp and cold nights of winter.

What should we do without this mineral? A lively and powerful imagination would strive in vain to conceive the consequences of its [illegible] urs. then, often to [illegible] rance, and grate- [illegible] the goodness of [illegible] coal, so often [illegible] what is far more [illegible]